OPERATION MANUAL

RC OSCILLATOR

MODEL 418B

KIKUSUI

On Power Supply Source, it is requested to replace the related places in the instruction manual with the following items.

(Please apply the item of √ mark)

☑ Power Supply Voltage: to ...120...VAC

☐ Line Fuse: to .....A

☑ Power Cable: to 3-core cable (See Fig. 1 for the colors)

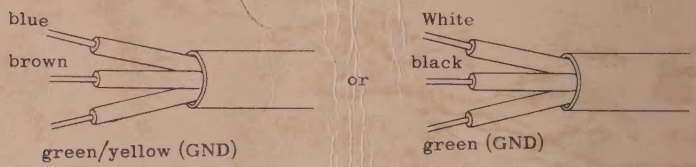


Fig. 1

Please be advised beforehand that the above matter may cause some alteration against explanation or circuit diagram in the instruction manual.

* AC Plug : In case of the Line Voltage 125V AC or more, AC Plug is in principle taken off and delivered, in view of the safety.

(AC Plug on 3-core cable is taken off in regardless of input voltages.)

Before using the instrument, it is requested to fix a suitable plug for the voltage used.

TABLE OF CONTENTS

1. GENERAL 1

2. SPECIFICATIONS 2

3. OPERATING PROCEDURE 4

3.1 EXPLANATION OF PANEL CONTROLS AND SWITCHES 4

3.2 OPERATING PROCEDURE 5

3.3 CHANGE OF SUPPLY LINE VOLTAGE 6

3.4 PRECAUTIONS 6

4. OPERATING PRINCIPLE 7

5. MAINTENANCE 9

5.1 CHASSIS INSPECTION 9

5.2 ADJUSTMENTS 10

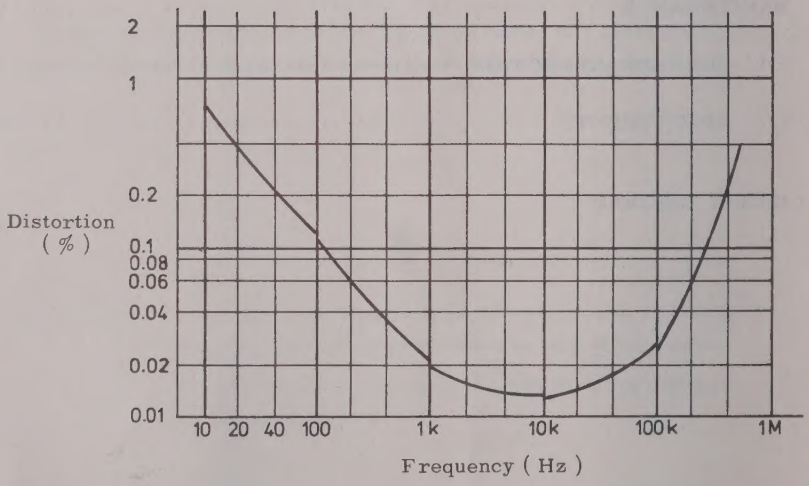
* CIRCUIT DIAGRAM

1. GENERAL

The MODEL 418B is a wide band RC oscillator which oscillates at 10Hz ~ 1MHz in five ranges. Being in corporated with a thermistor amplitude control circuit, the oscillator provides a sine wave with very minor output voltage variation and low distortion.

Since the oscillator employs schmitt circuit, it provides a square waveform with a fast rise time.

The output level is adjustable for a very wide range through combined use of a continuously variable attenuator, -20dB and -40dB stepwise attenuators.



Output voltage : maximum, load : 600Ω, ambient temperature : 25 °C

Fig. 1 Distortion characteristic (typical value)

2. SPECIFICATIONS

Power requirements	100 V 50/60 Hz, approx. 8 VA
Weight	Approx. 2.4 kg
Dimensions	110W x 140H x 252D mm
(Maximum dimensions)	(115W x 160H x 280D mm)
Ambient temperature	5 °C ~ 35 °C (Humidity: less than 85%)
Oscillation frequency	10 Hz ~ 1 MHz, in 5 range
Frequency ranges	x 10 ····· 10 ~ 100Hz
	x 100 ····· 100 ~1000Hz
	x 1K ····· 1k ~ 10 kHz
	x 10K ····· 10k ~100 kHz
	x 100K ····· 100k ~ 1 MHz
Frequency accuracy	± (3% + 1 Hz)
Output impedance	600Ω ± 10%
Output attenuator	Continuously variable control, and, -20dB (1/10) and -40dB (1/100) stepwise attenuators
Output terminal	5-way type, 19mm (3/4") distance
Output waveform	Sine wave and square wave

Sine wave (at maximum output voltage)

Output voltage	7 Vrms or over (open)	
(at 25°C)	3.5Vrms or over (with 600Ω load)	
Frequency characteristics	(1kHz reference, 600Ω load)	
	Within ± 0.5 dB	10Hz ~ 1 MHz
	Within ± 0.3 dB	20Hz ~ 500 kHz
Distortion factor	2 kHz ~ 60 kHz	0.04% or less
	800 Hz ~ 100 kHz	0.08% or less
	50 Hz ~ 500 kHz	0.8% or less
	10 Hz ~ 50 Hz	2 % or less

Square wave (at maximum output voltage)

Output voltage	8 Vp-p or over (600Ω load)
Rise time	0.2 μsec or faster (600Ω load)
Overshoot	2% or less (600Ω load)
Sag	5% or less (600Ω load at 50Hz)

Accessory Operation manual ..... 1 copy

3. OPERATION PROCEDURE

3.1 EXPLANATION OF PANEL CONTROLS AND SWITCHES

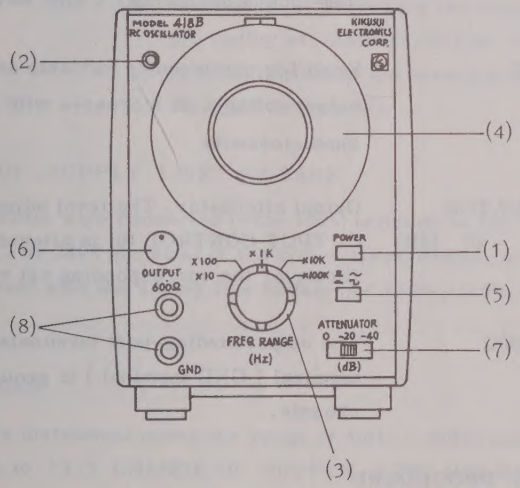


Fig. 2

(1) POWER — The main power switch. Depressed state is for power on. Pressing again the switch resets it to the popped up state or the power off state.

(2) Power pilot lamp — The light emitting diode lights when the power is on.

(3) FREQ RANGE — Frequency range selector rotary switch. The dial reading multiplied by the factor selected by this switch denotes the oscillating frequency.

(4) Frequency dial — For continuous variation (up to 10 times) of the oscillating frequency.

(5) ∿ ⊓ — Buttons to select either sine wave or square wave output.
Depressed position (▬) : square wave (⊓).
Non-locked position(▮) : sine wave (∿).

(6) OUTPUT — Knob for continuously variable adjustment of output voltage. It increases with turning this knob clockwise

(7) ATTENUATOR
0 -20 -40 (dB) — Output attenuator. The level adjusted by the OUTPUT CONTROL (6) is attenuated by the factor of the corresponding set value.

(8) GND, 600Ω — The output binding-post terminals. The black terminal (GND terminal) is grounded to the chassis.

3.2 OPERATING PROCEDURE

(1) Turning on the power — Press the power switch. The pilot lamp (light emitting diode) will turn on and the oscillator will become the stabilized oscillating state within a few seconds.

(2) Setting the oscillation frequency — Set the oscillation frequency with the FREQ RANGE selector and the frequency dial. The oscillation frequency is determined by the frequency dial reading multiplied by the factor selected by the FREQ RANGE selector.

Example 1 Setting 50 kHz
(1) Set the FREQ GANGE selector to x 10k.
(2) Set the frequency dial in the 5 position.

(3) Output waveform selection

Select (∿) (▮) or (⎍) (⎓) for a sine wave output or a square wave output.

(4) Output voltage setting

Adjust the output voltage with the OUTPUT control (6). The output voltage increases as this control is turned clockwise. The output attenuator (7) decreases the output voltage by the factor of -20dB (1/10) or -40dB (1/100) to be multiplied to the level adjusted by the OUTPUT control (6).

3.3 CHANGE OF SUPPLY LINE VOLTAGE

Change the white wire connected to the 100V terminal to the 110V, 117V, 220V, 230V, or 240V terminal of the power transformer, when operating this instrument with the supply line voltage of 110V, 117V, 220V, 230V or 240V.

3.4 PRECAUTIONS

(1) Use this instrument under the range of 50Hz ~ 60Hz and 90V ~ 110V. (Refer to "3.3 CHANGE OF SUPPLY LINE VOLTAGE" when changing the supply line voltage.)

(2) If the lead wires are too long, the specified output voltage : frequency characteristics may not become attainable.
Make the lead wires as short as possible.

(3) Since a thermistor is employed as the oscillation voltage control element, the output voltage is affected by ambient temperature (Approximately 0.4%/°C). If a constant output voltage is required for a long period, check the output with a voltmeter.

(4) Ambient temperature must be 5 °C ~ 35 °C.
Avoid using the oscillator in dusty environment or highly humid atmosphere.

4. OPERATING PRINCIPLE

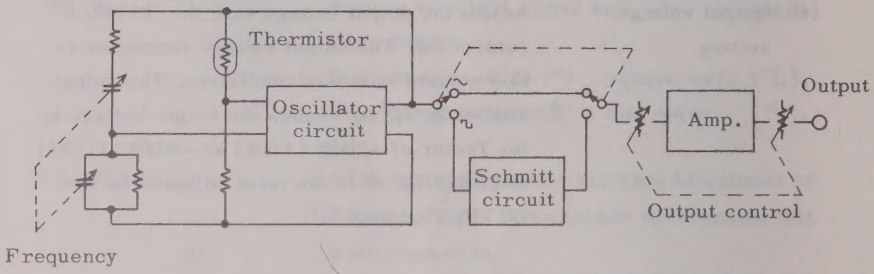


Fig. 1 Block diagram

Among low frequency oscillators, RC oscillators which employ R and C as frequency-determining elements are most common . Among RC oscillators, Wien bridge type is most popular. The Wien bridge has many advantages over other oscillation circuits. Its frequency is easily variable, and small distortion. The operating principle of the Wien bridge oscillator circuit is shown in Fig. 4.

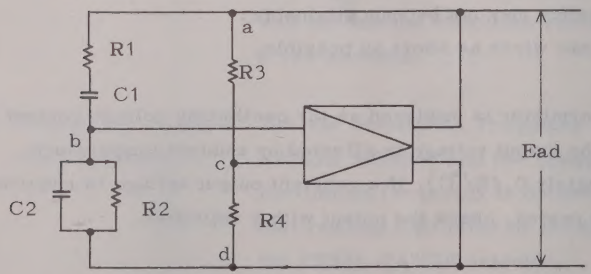


Fig. 4 Wien bridge oscillator circuit

Referring to Fig. 4, the phase of Ebc becomes the same with that of Ead when the below condition is satisfied.

$$f = \frac{1}{2\pi\sqrt{R1\ R2\ C1\ C2}} \tag{1}$$

The circuit oscillates when the below condition is satisfied.

$$Ebc = \left(\frac{1}{1 + \frac{R1}{R2} + \frac{C2}{C1}} - \frac{R4}{R3 + R4} \right) Ead \tag{2}$$

The circuit oscillates when the below condition is satisfied

$$\frac{1}{1 + \frac{R1}{R2} + \frac{C2}{C1}} - \frac{R4}{R3 + R4} \geqq \frac{1}{A} \tag{3}$$

The circuit oscillates stably when the below condition is satisfied.

$$\frac{1}{1 + \frac{R1}{R2} + \frac{C2}{C1}} - \frac{R4}{R3 + R4} = \frac{1}{A} \tag{4}$$

The conditions of oscillation are determined by equations (1) and (3), and they are not related with the oscillation amplitude. Therefore, the condition of equation (3) must be maintained until the oscillation builds up to the required amplitude. Then the circuit must satisfy the condition of equation (4). To accomplish this requirement, the resistance of R3 or R4 in Fig. 4 must automatically vary in response to the oscillation amplifier. This is accomplished by using a thermistor as for R3.

5. MAINTENANCE

5.1 CHASSIS INSPECTION

Remove two screws from the side of the case and two screws from the bottom of the case. Remove three rubber caps from the left side of the case and pull out the chassis from the housing.

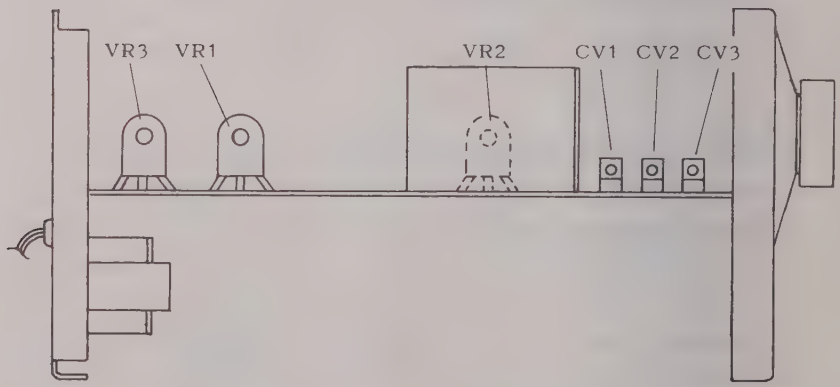


Fig. 5 Locations of controls

VR1	Oscillation circuit DC balance adjustment
VR2	Schumit circuit waveform symmetry adjustment of square wave.
VR3	+40V power supply circuit, voltage adjustment.
CV1	Frequency adjustment of the position 10 of the frequency dial.
CV2	Frequency adjustment in the x 10K range.
CV3	Frequency adjustment in the x 100K range.

5.2 ADJUSTMENTS

Referring to Fig. 5, make adjustments as below.

(1) DC supply voltage (+40V) adjustment.
Adjust the voltage as measured at TP4 of printed circuit board to +40V ± 0.5V by means of semi-fixed resistor VR3 .

(2) Oscillator DC balance adjustment
Set the FREQ RANGE selector to x 1K.
Adjust the voltage as measured at TP1 of printed circuit board to +19.5 ± 0.3V by means of semi-fixed resistor VR1.
(This adjustment must be performed patiently because the response is slow as a large capacitor is connected in this circuit.)

(3) Waveform symmetry adjustment of square wave
Set the FREQ RANGE selector to x 1K and set the output waveform to square wave. Observing the output with an oscilloscope, adjust the output waveform by means of semi-fixed resistor VR2 so that dimensions A and B illustrated below are made equal.

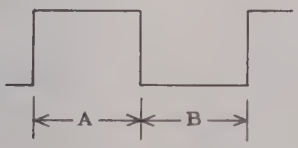


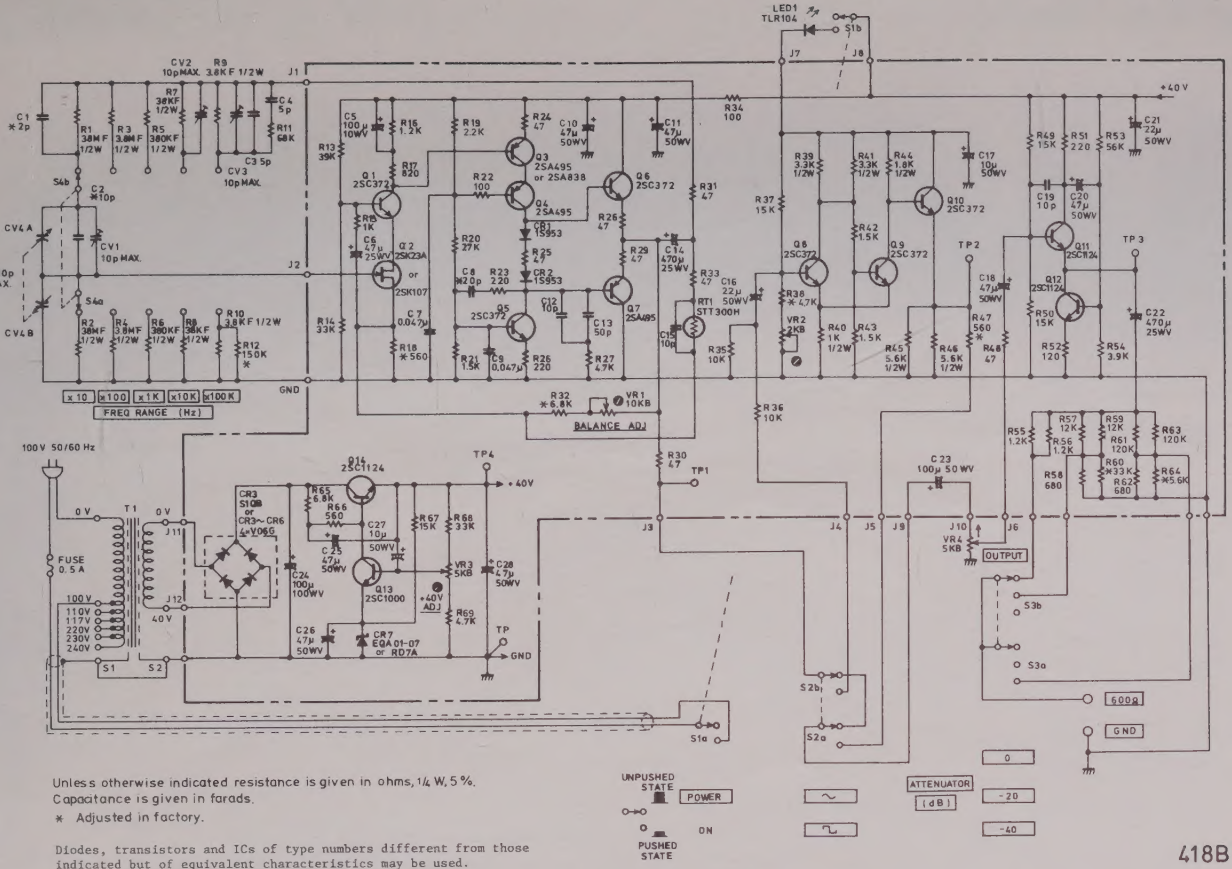
Fig. 6

(4) Frequency adjustment
Follow the below procedure for this adjustment.

1. Join surely the case to the chassis by tightening with screw.
2. Measure the frequencies corresponding to "1" position of the frequency dial and x100, x1K and x10K (100Hz, 1kHz and 10kHz respectively).

Adjust the frequency dial to the position where the errors are made minimum, and fix the dial in this position.

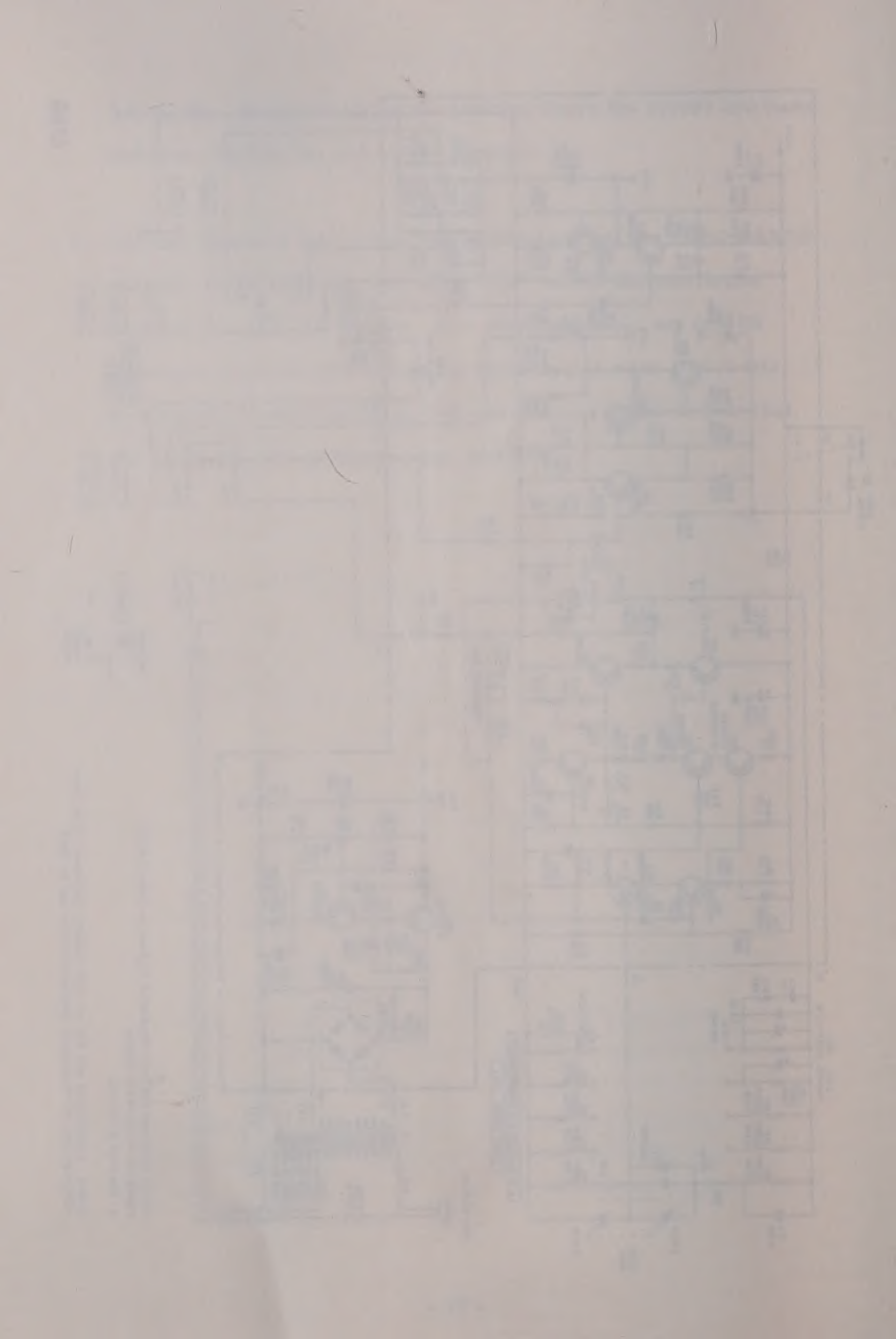
3. Set the frequency dial in the "10" position and set the FREQ RANGE selector to x1K position, and adjust CV1 so that the oscillation frequency is made 10.00 kHz. In a similar manner, set to x10K position and adjust CV2 so that the frequency is made 100.0 kHz. In a similar manner, set to x 100K position and adjust CV3 so that the oscillation frequency is made 1000 kHz.



Unless otherwise indicated resistance is given in ohms, 1/4 W, 5 %.
Capacitance is given in farads.
* Adjusted in factory.

Diodes, transistors and ICs of type numbers different from those indicated but of equivalent characteristics may be used.

418B



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